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(54) Fire extinguishing compositions.

(57) A fire extinguishing composition consisting of (a) one or more fire extinguishing compounds selected from bromodifluoromethane, 1-bromo-1,2,2,2-tetrafluoroethane, 1-chloro-1,2,2,2-tetrafluoroethane and 1,1-dichloro-2,2,2-trifluoroethane and optionally one or more of (b) a completely halogenated fluorobromoalkane(s) and/or fluorobromochloroalkane(s), (c) a coadjuvant agent(s) having a boiling point below 0° C and (d) a gaseous propellant(s).

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## FIRE EXTINGUISHING COMPOSITIONS

The present invention relates to fire extinguishing compositions.

In view of the concern surrounding possible damage to the ozone layer by certain halocarbons, a need has arisen to find alternative fire extinguishing compositions.

Accordingly, the present invention provides a fire extinguishing composition consisting essentially of:

- 5 (a) one or more fire extinguishing compounds selected from bromodifluoromethane ( $\text{CF}_2\text{HBr}$ ), 1-bromo-1,2,2,2-tetrafluoroethane ( $\text{CF}_3\text{CHFBr}$ ), 1-chloro-1,2,2,2-tetrafluoroethane ( $\text{CF}_3\text{CFHCl}$ ) and 1,1-dichloro-2,2,2-trifluoroethane ( $\text{CF}_3\text{CHCl}_2$ );

(b) optionally a completely halogenated fluorobromoalkane(s) and/or fluorobromochloroalkane(s);

(c) optionally a coadjuvant agent(s) having a boiling point below  $0^\circ\text{C}$ ; and

- 10 (d) optionally a gaseous propellant(s).

A further aspect of the present invention provides for a method of extinguishing a fire which comprises applying to said fire a fire extinguishing composition consisting essentially of:

- (a) one or more fire extinguishing compounds selected from bromodifluoromethane ( $\text{CF}_2\text{HBr}$ ), 1-bromo-1,2,2,2-tetrafluoroethane ( $\text{CF}_3\text{CHFBr}$ ), 1-chloro-1,2,2,2-tetrafluoroethane ( $\text{CF}_3\text{CFHCl}$ ) and 1,1-dichloro-2,2,2-trifluoroethane ( $\text{CF}_3\text{CHCl}_2$ );

(b) optionally a completely halogenated fluorobromoalkane(s) and/or fluorobromochloroalkane(s);

(c) optionally a coadjuvant agent(s) having a boiling point below  $0^\circ\text{C}$ ; and

(d) optionally a gaseous propellant(s).

- The fire extinguishing compositions of the invention may contain a single compound selected from 20 bromodifluoromethane ( $\text{CF}_2\text{HBr}$ ), 1-bromo-1,2,2,2-tetrafluoroethane ( $\text{CF}_3\text{CHFBr}$ ), 1-chloro-1,2,2,2-tetrafluoroethane ( $\text{CF}_3\text{CFHCl}$ ) and 1,1-dichloro-2,2,2-trifluoroethane ( $\text{CF}_3\text{CHCl}_2$ ) or they may contain a mixture of two or more of these compounds. Of these compounds bromodifluoromethane ( $\text{CF}_2\text{HBr}$ ) and 1-bromo-1,2,2,2-tetrafluoroethane ( $\text{CF}_3\text{CHFBr}$ ) are preferred, bromodifluoromethane ( $\text{CF}_2\text{HBr}$ ) being the most preferred.

- 25 In addition to the essential fire extinguishing compound(s), the fire extinguishing compositions of the invention may further comprise one or more fire extinguishing compounds selected from the completely halogenated fluorobromoalkanes and fluorobromochloroalkanes, such as 1,1,2,2-tetrafluoro-1,2-dibromoethane ( $\text{CF}_2\text{Br}-\text{CF}_2\text{Br}$ ), dibromodifluoromethane ( $\text{CF}_2\text{Br}_2$ ), bromotrifluoromethane ( $\text{CF}_3\text{Br}$ ), and bromochlorodifluoromethane ( $\text{CF}_2\text{ClBr}$ ). Of these dibromodifluoromethane ( $\text{CF}_2\text{Br}_2$ ) is preferred.

- 30 The fire extinguishing compositions of the invention may also comprise one or more coadjuvant agents having a boiling point below  $0^\circ\text{C}$  (hereinafter referred to as coadjuvants), which may enhance the effectiveness of the fire extinguishing compositions, e.g. on delivery from a fire extinguishing device. Preferred coadjuvants are the haloalkanes, especially the haloethanes and halomethanes, having a boiling point below  $0^\circ\text{C}$ , preferred examples of which are chlorodifluoromethane, 1,1,2,2-tetrafluoroethane and 35 1,1,1,2-tetrafluoroethane. Coadjuvants may, for example, be advantageously employed when 1,1-dichloro-2,2,2-trifluoroethane ( $\text{CF}_3\text{CHCl}_2$ ) is used as the sole or major fire extinguishing compound in the compositions of the invention, since 1,1-dichloro-2,2,2-trifluoroethane ( $\text{CF}_3\text{CHCl}_2$ ) has a boiling point of  $27^\circ\text{C}$ , and is therefore a liquid at normal ambient temperatures. However, the use of coadjuvants in the fire extinguishing compositions of the invention is not essential, particularly where fire extinguishing compounds having a 40 boiling point below  $0^\circ\text{C}$  are employed. For example, if bromodifluoromethane ( $\text{CF}_2\text{HBr}$ ) and/or 1-chloro-1,2,2,2-tetrafluoroethane ( $\text{CF}_3\text{CFHCl}$ ) are employed as the fire extinguishing compounds, their boiling points ( $-15^\circ\text{C}$  and  $-12^\circ\text{C}$  respectively) are sufficiently low that they may be effectively discharged from a fire extinguishing device without the need for a coadjuvant. Even where a fire extinguishing compound having a boiling point above  $0^\circ\text{C}$ , such as 1,1-dichloro-2,2,2-trifluoroethane ( $\text{CF}_3\text{CHCl}_2$ ) is used, a fire extinguishing 45 composition containing such a compound may be effectively discharged from a fire extinguishing device by employing another fire extinguishing compound(s) in combination therewith which has a boiling point below  $0^\circ\text{C}$ . These other fire extinguishing compounds may be selected, for example, from bromodifluoromethane and/or 1-chloro-1,2,2,2-tetrafluoroethane and/or the fully halogenated fluorobromoalkanes and/or fluorobromochloroalkanes. Notwithstanding the above, fire extinguishing compositions containing one or 50 more coadjuvants may be preferred.

The fire extinguishing compositions of the invention will typically comprise one or more gaseous propellants in order to expedite the discharge thereof, e.g. from a fire extinguishing device. Suitable propellants are compounds of low toxicity and high stability, preferred examples of which are nitrogen and carbon dioxide.

Where the fire extinguishing compositions of the invention comprise other compounds in addition to the

essential fire extinguishing compound(s), such as additional fire extinguishing compounds selected from the completely halogenated fluorobromoalkanes and fluorobromochloroalkanes and/or coadjuvant agents and/or gaseous propellants, the proportion of the essential fire extinguishing compound(s) may vary within wide limits. For example, a suitable fire extinguishing composition may comprise from as little as 5 % by volume to as much as 95 % by volume of the at least one essential fire extinguishing compound(s), based on the total volume of the fire extinguishing composition.

The present invention is now illustrated, but not limited, by the following examples.

#### 10 EXAMPLE 1

The lowest concentration of the essential fire extinguishing compounds in air sufficient to extinguish a flame was determined using the Cup Burner method (see Fire Technology Vol. 13, No.4, November 1977, pp 296 -315).

15 A burner supplied with n-heptane was arranged in a glass apparatus to which air was supplied at a linear velocity of about 14 cm/s. The concentration of the fire extinguishing compound in the air was gradually increased until the flame was extinguished.

Table 1 lists the concentration of each fire extinguishing compound in air (volume %) at the moment of extinction of the flame.

20 TABLE 1

FIRE EXTINGUISHING COMPOUND	CONCENTRATION IN AIR (Volume %) AT POINT OF EXTINCTION
CF <sub>2</sub> HBr	4.5
CF <sub>3</sub> CFHCl	7.8
CF <sub>3</sub> CHCl <sub>2</sub>	6.3
CF <sub>3</sub> CFHBr	3.6

#### 35 EXAMPLE 2

A Committee European Normalisation (CEN) 17B fire was started using 17 litres of n-heptane as the fuel. The fire was extinguished in 4 seconds using 1200 g of 1-chloro-1,2,2,2-tetrafluoroethane discharged in 8 seconds from a 1230 ml Thorn extinguisher by 130 psi of nitrogen.

#### 45 EXAMPLE 3

A Committee European Normalisation (CEN) 13B fire was started using 13 litres of n-heptane as the fuel. The fire was extinguished in 4.5 seconds using a mixture of 725 g of 1,1-dichloro-2,2,2-trifluoroethane + 80 g chlorodifluoromethane discharged in 8 seconds from a 760 ml Thorn extinguisher by 130 psi of nitrogen.

#### 50 EXAMPLE 4

55 A Committee European Normalisation (CEN) 21B fire was started using 21 litres of n-heptane as the fuel. The fire was extinguished in 6 seconds using a mixture of 1200 g of 1,1-dichloro-2,2,2-trifluoroethane + 135 g chlorodifluoromethane discharged in 8 seconds from a 1230 ml Thorn extinguisher by 130 psi of nitrogen.

EXAMPLE 5

A Committee European Normalisation (CEN) 13B fire was started using 4 litres of n-heptane as the fuel. The fire was extinguished in 1.5 seconds after allowing the fire to burn for 20 seconds, using 359 g of  
 5 bromodifluoromethane discharged from a 1230 ml Thorn extinguisher containing 1258 g of bromodifluoromethane pressurised to 150 psi with nitrogen.

EXAMPLE 6

10 A Committee European Normalisation (CEN) 21B fire was started using 21 litres of n-heptane as the fuel. The fire was extinguished in 2.0 seconds after allowing the fire to burn for 60 seconds, using 452 g of bromodifluoromethane discharged from a 1230 ml Thorn extinguisher containing 920 g of bromodifluoromethane pressurised to 100 psi with nitrogen.

EXAMPLE 7

20 A Committee European Normalisation (CEN) 13B fire was started using 4 litres of n-heptane as the fuel. The fire was extinguished in 1.1 seconds, after allowing the fire to burn for 20 seconds, using 360 g of 1-bromo-1,2,2,2-tetrafluoroethane discharged from a 1230 ml Thorn extinguisher containing 1510 g of 1-bromo-1,2,2,2-tetrafluoroethane pressurized to 150 psi with nitrogen.

EXAMPLE 8

25 A Committee European Normalisation (CEN) 21B fire was started using 21 litres of n-heptane as the fuel. The fire was extinguished in 2.2 seconds, after allowing the fire to burn for 60 seconds, using 680 g of 1-bromo-1,2,2,2-tetrafluoroethane discharged from a 1230 ml Thorn extinguisher containing 1150 g of 1-bromo-1,2,2,2-tetrafluoroethane pressurized to 140 psi with nitrogen.

EXAMPLE 9

35 A Committee European Normalisation (CEN) 55B fire was started using 55 litres of n-heptane as the fuel. The fire was extinguished in 3.5 seconds, after allowing the fire to burn for 60 seconds, using 950 g of a 30/70 v/v blend of bromodifluoromethane/dibromodifluoromethane discharged from a 1230 ml Thorn extinguisher containing 1900 g of the blend pressurised to 130 psi with nitrogen.

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**Claims**

1. A fire extinguishing composition consisting essentially of:
  - (a) one or more fire extinguishing compounds selected from bromodifluoromethane 1-bromo-1,2,2,2-tetrafluoroethane, 1-chloro-1,2,2,2-tetrafluoroethane and 1,1-dichloro-2,2,2-trifluoroethane;
  - (b) optionally a completely halogenated fluorobromoalkane(s) and/or fluorobromochloroalkane(s);
  - (c) optionally a coadjuvant agent(s) having a boiling point below 0 °C; and
  - (d) optionally a gaseous propellant(s).
2. A fire extinguishing composition as claimed in claim 1 wherein the fire extinguishing compound of  
 50 component (a) is bromodifluoromethane.
3. A fire extinguishing composition as claimed in claim 1 wherein the fire extinguishing compound of component (a) is 1-bromo-1,2,2,2-tetrafluoroethane.
4. A fire extinguishing composition as claimed in any one of the preceding claims which contains a completely halogenated fluorobromoalkane(s) and/or fluorobromochloroalkane(s).
- 55 5. A fire extinguishing composition as claimed in claim 4 which contains a completely halogenated fluorobromoalkane which is dibromodifluoromethane.
6. A fire extinguishing composition as claimed in any one of the preceding claims which contains a coadjuvant agent(s) having a boiling point below 0 °C.

7. A fire extinguishing composition as claimed in claim 6 wherein the coadjuvant agent(s) having a boiling point below 0 °C is a haloalkane.

8. A fire extinguishing composition as claimed in claim 7 wherein the haloalkane is chlorodifluoromethane.

5 9. A fire extinguishing composition as claimed in any one of the preceding claims which contains a gaseous propellant(s).

10. A fire extinguishing device comprising a fire extinguishing composition as claimed in any one of the preceding claims.

10 11. A method of extinguishing a fire which comprises applying to said fire a fire extinguishing composition consisting essentially of:

(a) one or more fire extinguishing compounds selected from bromodifluoromethane 1-bromo-1,2,2,2-tetrafluoroethane, 1-chloro-1,2,2,2-tetrafluoroethane and 1,1-dichloro-2,2,2-trifluoroethane;

(b) optionally a completely halogenated fluorobromoalkane(s) and/or fluorobromochloroalkane(s);

(c) optionally a coadjuvant agent(s) having a boiling point below 0 °C; and

15 (d) optionally a gaseous propellant(s).

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(54) Fire extinguishing compositions.

(57) A fire extinguishing composition consisting of (a) one or more fire extinguishing compounds selected from bromodifluoromethane, 1-bromo-1,2,2,2-tetrafluoroethane, 1-chloro-1,2,2,2-tetrafluoroethane and 1,1-dichloro-2,2,2-trifluoroethane and optionally one or more of (b) a completely halogenated fluorobromoalkane(s) and/or fluorobromochloroalkane(s), (c) a coadjuvant agent(s) having a boiling point below 0 °C and (d) a gaseous propellant(s).

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## EUROPEAN SEARCH REPORT

Application Number

EP 90 30 0774

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-2 021 981 (F.R. BICHOWSKY) * Page 1, left-hand column, line 41 - right-hand column, line 15; claims 3,4,6-15 *	1,6-11	A 62 D 1/08
X	US-A-4 810 403 (D.B. BIVENS et al.) * Claims 1,4 *	1,2,6-9	
X	US-A-4 198 313 (G. BARGIGIA et al.) * Column 2, lines 1-16 *	1,4	
A	FR-A-1 605 545 (ETAT FRANCAIS) * Page 1, line 27 - page 2, line 11; claims 1,3. *	1,4,5, 9-11	
A	GB-A-1 132 636 (MONTECATINI EDISON) * Page 2, line 22 - page 3, line 34; page 4, table and lines 1-19; claims *	1-11	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			A 62 D
Place of search		Date of completion of search	Examiner
The Hague		01 February 91	FLETCHER A.S.
<b>CATEGORY OF CITED DOCUMENTS</b>			
X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention		E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons &: member of the same patent family, corresponding document	